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DIVISION OF
OIL GAS & MINING

May 18, 1993

Mr. Wayne Hedberg
Department of Natural Resources
Division of Oil, Gas and Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, UT 84180-1203

DOGM
MINERALS PROGRAM
FILE COPY

Reference: Summary of Solution Release at Goldstrike Mine
During January and February 1993.

Dear Mr. Hedberg:

Enclosed is a summary report on the release events at the Goldstrike Mine earlier this year. We appreciate your understanding that significant time was required to obtain and analyze data relative to the release. This report is a summary of the areas of significant concern and is not intended to contain all data. A full report, prepared by an environmental consultant firm, including results of all downstream sampling is being submitted to the Division of Water Quality which has full regulatory authority in this matter.

We are confident that there were no detrimental effects to the environment.

As in the past, we welcome any questions or concerns you may have.

Sincerely,

USMX OF UTAH, INC.

Robert K. Wilson

Robert K. Wilson
Environmental Coordinator

RKW:bas

USMX of Utah, Inc.

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DIVISION OF
OIL GAS & MINING

**USMX of Utah, Inc. Goldstrike Mine
Summary of the Winter, 1993 Discharge Events at the Goldstrike Mine**

May 10, 1993

Prepared by: Richard Jolk P.E.

USMX

SUMMARY

USMX of Utah, Inc. operates the Goldstrike gold mine located approximately 38 miles Northwest of St. George, Utah. Open pit mining is used to extract the ore from the ground with a cyanidation heap leach process to recover the gold from the ore.

The mine and facilities were constructed in 1987 and 1988; including haulroads, waste rock dumps, topsoil preserves, stormwater diversion ditches, heap pads, solution ponds, a laboratory, process facilities, and administration offices. In addition to sound design and construction of facilities, environmental monitoring and sampling procedures are used to insure safe and efficient operations as stipulated by the permits.

Of primary concern during the design of the fluid management system was the capability of this system to withstand extraordinary precipitation events. Construction of this project took place only after all designs and procedures had been thoroughly reviewed by the state and federal regulatory agencies to ensure an environmentally sound operation.

Over 6 million tons of ore have been mined, hauled, and processed during the past 5 years of operation. Goldstrike management has made every effort to comply with all environmental regulations to the best of their ability. Current continuing operations would not be allowed by the various pertinent regulatory agencies if this were not the case.

Major snowfalls and rainfalls during the winter of 1992 to 1993, introduced volumes of fresh water into the fluid management system far beyond any expected amount that the facility was designed to handle. Design and permitting of the heap leach system was based on containing a 100 year -- 24 hour precipitation event in addition to normal operating solution volumes, which is the regulatory standard. A cumulative total of 20.52 inches of precipitation fell at the minesite beginning December 27, 1992, and ending February 26, 1993. This event introduced a total of 26.4 million gallons of solution into the fluid management system.

Pursuant to standard procedures, before the winter rainfall begins, steps are taken to minimize both the concentration of cyanide in process solution and the total amount of solution volume in the ponds, thereby increasing the available storage capacity. When the rainfall began on December 27, 1992, cyanide addition was stopped entirely, specifically in the event that such a large precipitation event may occur. Anticipation of precipitation in these months is based on historical rainfall measurements that show December through April to be the wettest months of the year in this area.

On January 19, 1993, and again on February 8, 1993, it became imperative to treat and discharge solution from the fluid management system to prevent solution from overflowing the ponds in an uncontrolled manner. Controlled solution treatment and discharge that was performed minimized the environmental impact of the emergency release by 1) substantially reducing the cyanide concentration in solution before discharge and 2) preventing overtopping of the ponds that could have led to erosion of the foundation soils supporting the ponds and ultimately causing a loss of structural integrity and pond failure.

A third party environmental consultant was contracted to oversee the sampling program initiated before the discharge began and document the efforts and results of the sampling program over the course of the discharge in a non-biased manner. This helped to substantiate the activities that occurred on-site during the release and the effort extended by mine management to effectively deal with the situation encountered.

Treated solution was pumped to the sediment dam that had been constructed in previous years to contain and settle eroded sands, silts, and clays that become collected by the stormwater control system outside the fluid management system during heavy runoff. The mean concentration of free cyanide (CN_{free}) during the discharge event decreased down gradient from 0.676 milligrams free cyanide per liter ($mgCN_{free}/l$) in the sediment pond to 0.004 $mgCN_{free}/l$ in the East Fork of Beaver Dam Wash. No detectable free cyanide concentrations in excess of drinking water standards or of 3A Numeric Criteria for Aquatic Life water quality standards were observed throughout the duration of discharge at the main branch of Beaver Dam Wash. In addition, no detectable concentrations in excess of drinking water standards or of 3A Numeric Criteria for Aquatic Life water quality standards for mercury, selenium, cadmium, iron, nitrate, sulfate, chloride, total dissolved solids, or pH were observed throughout the duration of discharge at Beaver Dam Wash.

Analyses of the heavy precipitation events, the preventative measures taken before the rain began, the manner in which the treatment and discharge was handled when it became necessary to do so, and results from the monitoring and sampling of several points downgradient of the mine in conjunction with third party oversight all indicate that the mine facilities were operated in a professional manner, without negligence, and without demonstrated or anticipated environmental impact.

GOLDSTRIKE MINE -- LOCATION, ACCESS, GEOGRAPHY, CLIMATE

USMX of Utah, Inc. operates the Goldstrike Mine which is an open pit gold mine and cyanide heap leach facility in the Goldstrike Mining District of the Bull Valley Mountains in Northwest Washington County, Utah. The project is located 38 miles Northwest of St. George, Utah, in Sections 16, 17, 20, and 21 of T39S, R18W.

Access to the site is via 15 miles of paved road from St. George to the junction of Motoqua Road, then Northwest on the Motoqua Road No. 42529 for a distance of 15 miles to the D.I. Ranch Road junction, then 8 miles northeast to the mine site.

The project infrastructure consists of several open pits, waste rock dumps, a crusher, heap leach pads, solution ponds, an activated carbon processing facility, and several administrative and engineering offices.

Significant geographic relief consisting of rolling hills and mountainous terrain is present at the site. The pits, pads, and process facilities have all been adapted to the natural terrain while maintaining the necessary elevation gradients for solution flow and collection.

The site is located at an elevation of approximately 5300 feet above sea level. Summers are hot with temperatures up to 100°F or higher. Winter temperatures can be sub-zero and snow flurries are encountered regularly. Average annual precipitation is roughly 12 inches, most of which falls between December through April, inclusive.

FLUID MANAGEMENT SYSTEM CONCEPT AND DESIGN

The fluid management system is the key to containing and controlling process solution and water from rainfall and snowfall events. The facility is located in a region of negative water balance, meaning that there is more net evaporation than precipitation on an annual basis. The fluid management system is called a "zero discharge system" or a

"closed system" because it was designed for the climate exhibited in this region to contain and control all process solution plus the total amount of precipitation from a 100 year -- 24 hour event.

Total pond capacity of the original fluid management system was 4.3 million gallons, plus 0.6 million gallons of fresh water storage capacity. After the precipitation event in Spring, 1991, it was decided to increase the total fluid management system capacity by adding an additional 3 million gallon rinse water pond at the foot of pad #1. This increased the total volumetric capacity of the fluid management system to 7.9 million gallons or 161% of the original designed and permitted capacity. Total "fall-on" surface area is 47.5 acres or 2,066,250 square feet which includes all pads, ponds, and solution ditches. Calculations indicate that delivery of one inch of precipitation onto the surface of the fluid management system captures 1,288,052 gallons of solution.

Cyanide concentration maintained in the fluid management system differs at various points throughout the operation. Leach solution applied to the top of heaps usually contains about 200 mgCN_{free}/l. By the time leach solution has returned to the pregnant solution pond the cyanide concentration is approximately 100 mgCN_{free}/l.

EMERGENCY TREATMENT FACILITIES

On-site capability to treat spills and discharges by destroying cyanide in solution is required by permit. Calcium hypochlorite in quantities sufficient to treat relatively small spills are maintained at the facility for such events. In addition to maintaining a stock of calcium hypochlorite on site, management maintains treatment equipment and neutralizing chemicals to deal with emergency spills. It was the additional capability maintained by management that effectively allowed treatment of cyanide solutions by alkaline chlorination.

Current facilities used to treat solution in such emergencies consist of, a chlorine gas addition unit, a mixing tank for addition of lime, and a solution circulation and discharge pump. Treatment begins upon commencement of filling a 600,000 gallon retention pond. Solution is pumped into the pond at a rate of 1,000 gallons per minute. Chlorine introduced from manifolded chlorine cylinders passes through a gas regulator and is metered by rotometers before being drawn into the solution through two eductors. Slurried lime is mixed with the chlorinated solution in the pond forming hypochlorite which is a strong oxidizer that quickly and thoroughly neutralizes cyanide. Solution is treated in batches to insure that the cyanide is neutralized before release. After sample analysis has been performed to determine that cyanide neutralization is complete, the solution is aerated to reduce residual chlorine content. The treated solution is then pumped out of the pond to the sediment dam where soil filtration further reduces free cyanide content and the fine particulates present in the solution are allowed to settle.

ENVIRONMENTAL REGULATION AND COMPLIANCE

Since the beginning of the project all necessary permits required to operate the mine have been obtained from the agencies listed below:

U.S. Bureau of Land Management
Utah Division of Oil, Gas, and Mining

USMX

Utah Division of Water Quality
Utah Division of Air Quality
Utah Southwest District Health Department

Monthly and quarterly reports are submitted to these various agencies as a matter of permit compliance. Results of monitoring and/or sampling several areas of interest are presented in these reports. Results from water samples taken both upgradient and downgradient from the mine site are submitted regularly. Slight pad movements due to natural slumping are detected by inclinometers and reported on a regular basis. Total tonnage's mined, hauled, and delivered to the pad, overall fuel consumption, and the total number of blast holes drilled daily is reported on a regular basis.

All permits are written such that if monitored or sampled results are not within the specified bounds of the permit it becomes mandatory to either include the results of the monitoring or sampling in the next report or to immediately notify the appropriate agency depending upon the situation. This system guarantees that mine management and the various agencies keep abreast of situations as they develop and work together in defining the appropriate action to be taken.

PRECIPITATION AND DISCHARGE EVENTS

Substantial precipitation events occurred at the Goldstrike facility between December 27, 1992, and February 26, 1993. A total of 16.71 million gallons of rain water (the equivalent of over 3.8 times the volume that would have been delivered by a 100 year -- 24 hour event) had fallen onto the heap leach pads and ponds by January 19, 1993. On this date, after completely filling all solution ponds to maximum design capacity and into the freeboard zone, it became imperative to treat and release dilute process solution in order to prevent an uncontrolled discharge that may have endangered public health and the environment more so than would a controlled discharge. A total of 2.45 million gallons of solution was treated and released.

Five days later on January 24, 1993, it appeared that it would be possible to contain the remaining solution in the fluid management system therefore treatment and discharge of solution ceased. This decision was made after the rain had stopped for 5 days and with the knowledge that a new emergency pond would be completed and available for use the next morning, January 25, 1993.

On January 30, 1993, the rain began again. The Goldstrike mine received an additional 7.54 inches of moisture by February 26, 1993. On February 8, 1993, it once again became necessary to treat and release dilute solution in order to prevent an uncontrolled discharge. By this point in time a total of 21.13 million gallons (the equivalent of more than 6.2 times the volume of a 100 year -- 24 hour event) had entered the fluid management system.

Discharge ended on March 1, 1993, after an additional 6.31 million gallons of solution had been treated and released bringing the total to 8.76 million gallons.

In all, a total of 20.52 inches of precipitation fell onto the fluid management system. As described in the section pertaining to the fluid management system, calculations indicate that delivery of one inch of precipitation onto a 47.5 acre surface captures 1,288,052 gallons of solution. Multiplying 1,288,052 gallons per inch of

precipitation by the 20.52 inches of precipitation encountered shows that 26.75 million gallons entered the fluid management system due to precipitation.

MEASURES TAKEN TO MINIMIZE IMPACT BEFORE RELEASE

Fresh water is used for make-up water in the dry months. In late summer the use of make-up water is reduced and eventually stopped in preparation for the wet season. By December 27, 1992, the day when the rain began, the ponds in total contained less than 900,000 gallons of solution. This was due to long-term management foresight and experience in the proper operation of heap leach facilities.

Interceptor ditches which divert stormwater runoff around and away from the fluid management system are regularly inspected throughout the year with particular attention being given to these ditches in late fall. This prevents stormwater runoff from entering the system.

In late fall, cyanide solution concentrations are reduced far below normal operating parameters in preparation for potential severe precipitation events. Cyanide concentration in the solution return to the pregnant solution pond was reduced to 60 mgCN_{free}/l by December 27, 1992, the day the rain began, from a normal operating concentration of 100 mgCN_{free}/l.

Cyanide addition was stopped entirely the very first day of rain, specifically in response to the possibility that such a large precipitation event may occur. Had cyanide addition not been stopped on December 27, 1992, higher cyanide concentrations would have been realized in the pond and treatment requirements would have increased substantially.

Heaps that are below saturation content can hold substantial amounts of additional water by acting much like giant sponges. Water that would have otherwise been treated and released was absorbed by the heaps through increased pumping to the heaps. By increasing the pumping to the heaps it was possible to contain much more solution in the fluid management system than if increased pumping had not occurred.

A temporary 3.7 million gallon pond was constructed on top of pad #2 during the first weeks of the event and was completed on January 25, 1993. This allowed an additional 3.7 million gallons of solution to be contained thereby increasing the total pond capacity to 11.7 million gallons (including freeboard).

All required and requested notifications were made to Federal, State, and Local agencies, including the Division of Water Quality, regarding the mine's intentions to treat and discharge. These notifications were all made before any solution was discharged.

SOLUTION TREATMENT AND CONTROLLED DISCHARGE

It was not until all preventive measures and mitigating techniques had been implemented, including all those listed above, that treatment and discharge of solution began. A total of 6.9 million gallons of solution was contained in the ponds when it became necessary to treat and discharge. Solution gain into the ponds, which is the sum of solution from the pads to the ponds less the amount of solution being pumped from the ponds to the heaps, was roughly 70,000 gallons per hour. At this rate of increase it was projected that the ponds would have overflowed within 14 hours if controlled treatment and discharge had not been implemented.

Cyanide concentration in the ponds was roughly 13 mgCN_{free}/l when it became necessary to treat and discharge solution. This concentration is low in comparison to the 60 mgCN_{free}/l present at the beginning of the rainfall and is due to both dilution and cyanide degradation at the lower pH values.

Initially, hydrogen peroxide was used to treat solution prior to discharge. Cyanide destruction using hydrogen peroxide is a sensitive process to operate, especially under emergency conditions, and requires several hours of residence time in cases where less than perfect mixing is available. Treatment of solution by hydrogen peroxide at the start of the first release on January 19, 1993, proved to be somewhat ineffective. Free cyanide concentration was reduced by less than 50% to 8.1 mgCN_{free}/l.

One day later on January 20, 1993, realizing that hydrogen peroxide treatment would not suffice, treatment by alkaline chlorination was implemented to neutralize cyanide. Cyanide concentrations in solutions treated by alkaline chlorination ranged from 1.7 to 0.24 mgCN_{free}/l cyanide during the first discharge period. Treated discharge continued for 5 days through January 25, 1993, at which time the rainfall had stopped, and the new 3.7 million gallon pond on top of pad #2 had been completed. At this point it appeared that it might be possible to contain all of the remaining solution.

Rainfall began again on January 30, 1993, and continued off and on through February 26, 1993. It once again became imperative to discharge solution on February 8, 1993. A batch alkaline chlorination system was used to treat solution during this discharge. Cyanide concentrations during this discharge period ranged from undetectable levels to no higher than 0.05 mgCN_{free}/l cyanide with an average of 0.0245 mgCN_{free}/l cyanide. Solution treatment and discharge continued through March 1, 1993, at which time safe pond operating levels were re-established.

RESULTS OF ENVIRONMENTAL SAMPLING

Sampling frequency was increased during and after the discharge to ensure an accurate account of the constituents contained in both the discharged solutions and in the water's downgradient. Sampling frequency was also increased at monitoring wells both up gradient and down gradient of the facility.

Samples were taken in the fresh water pond for operational control of the treatment system on a continuous basis by operations personnel. End of the pipe free cyanide concentration during the first release period averaged 2.72 mgCN_{free}/l with a total of 2.48 million gallons being discharged. End of the pipe free cyanide concentration during the second release period averaged 0.0245 mgCN_{free}/l with a total of 6.31 million gallons being discharged.

Additional sampling points included the sediment pond, the mouth of Arsenic Gulch above the confluence with the East Fork of Beaver Dam Wash, the East Fork of Beaver Dam Wash approximately 3,000 feet below the mouth of Arsenic Gulch, the East Fork of Beaver Dam Wash approximately 8.5 miles below the mouth of Arsenic Gulch, and in Beaver Dam Wash just below the confluence with the East Fork of Beaver Dam Wash. The East Fork of Beaver Dam Wash is an intermittent drainage that had been dry for at least six years since the project commenced. Beaver Dam Wash is located 8 linear miles down gradient from the point at which solution entered the East Fork of Beaver Dam Wash.

All upgradient and downgradient monitor wells are now tested on a monthly basis as compared to the quarterly basis being followed before the discharge. This will continue until it is certain that no residual effect from this event has occurred. One monitor well down gradient, just below the sediment pond detected cyanide in solution. Cyanide concentration detected in this well was 0.06 mgCNwad/l, well below the 0.22 mgCNwad/l standard in the permits. No other monitoring wells have given any indication of elevated cyanide concentrations.

Results from downstream sampling in the East Fork of Beaver Dam Wash just above Beaver Dam Wash proper, both during and after each of the discharge events, indicate that all Drinking water standards and all class 3A numerical criteria for aquatic life standards were met at Beaver Dam Wash. No environmental damage due to any constituent in the discharged solution is evident nor speculated anywhere downgradient from the discharge point.

IMPACT OF DISCHARGE

Results from the sampling performed both during and after the discharges indicate that no environmental damage has occurred or is expected. Frequency of sampling both upgradient and downgradient has been increased above normal sampling frequencies and will continue until it becomes evident what the impact of this scenario has been. Current observations of the area indicate that no environmental damage has occurred.

USMX

FACSIMILE TRANSMISSION COVER

FAX NUMBER: 702-289-8909

DATE: 5/18/93 TIME 9:00 am

TO: ATTENTION Robert Wilson

COMPANY USMX - ALLIGATOR RIDGE MINE

FROM: PV SENT BY: _____

NUMBER OF PAGES (INCLUDING COVER) 9

MESSAGE

Summary Report

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